

What is claimed is:

- 1) An apparatus for electrochemically analyzing an aqueous sample solution comprising electrochemically reversible materials in solution, said apparatus comprising:
  - a) a coulometric guard cell operated in an oxidative mode, said coulometric guard cell arranged in series with an analytical cell which is downstream from the guard cell, said guard cell and said analytical cell being arranged so as to define collectively at least one flow channel for said sample solution;
  - b) said analytical cell consisting essentially of a series of at least two coulometric electrodes, wherein the first electrode operates in a reductive mode and the second electrode operates in an oxidative mode at a potential which simultaneously detects and coulometrically measures electrochemically reversible materials in said sample solution.
- 2) The apparatus of claim 1 wherein the aqueous sample solution passes through a liquid chromatographic column for achieving time-spaced separation of materials prior to passing through said coulometric guard cell and said analytical cell.
- 3) The apparatus of claim 2 wherein said coulometric guard cell is operated at about +700 mV.

- 4) The apparatus of claim 3 wherein said first electrode of the analytical cell is operated at about  $-650$  mV and the second electrode of the analytical cell is operated at about  $+500$  mV.
- 5) The apparatus of claim 4 wherein said aqueous sample solution comprises a mixture of quinones and hydroquinones in a biological fluid.
- 6) The apparatus of claim 5 wherein said aqueous sample solution comprises a mixture of  $\text{CoQ}_{10}$  and  $\text{CoQ}_{10}\text{H}_2$ .
- 7) The apparatus of claim 6 wherein the biological fluid is selected from the group consisting of plasma, serum, urine, CSF, amniotic fluid and blood.
- 8) The apparatus of claim 7 wherein said biological fluid is heparinized human plasma.
- 9) The apparatus of claim 8 wherein the aqueous sample solution is diluted with 1-propanol.
- 10) A method for simultaneously analyzing a mixture of electrochemically reversible materials comprising the steps of:
  - 5 a) passing said materials through a liquid chromatographic column for achieving time-spaced separation of the materials eluted from the column;

b) oxidizing said materials by passing the materials through a coulometric guard cell;

- 10 c) passing said materials through an analytical cell consisting essentially of a series of at least two coulometric electrodes, wherein the first electrode operates in a reductive mode and the second electrode operates in an oxidative mode at a potential so as to detect and coulometrically measure electrochemically reversible materials in said sample;

15

said at least two coulometric electrodes being arranged in series and defining collectively at least one flow channel for said sample solution.

11) The method of claim 10 wherein said coulometric guard cell is operated at about +700 mV.

12) The method of claim 11 wherein said first electrode of the analytical cell is operated at about -650 mV and the second electrode of the analytical cell is operated at about +500 mV.

13) The method of claim 12 wherein said aqueous sample solution comprises a mixture of quinones and hydroquinones in a biological fluid.

14) The method of claim 13 wherein the biological fluid is selected from the group consisting of plasma, serum, urine, CSF, amniotic fluid and blood.

- 15) The method of claim 14 wherein said aqueous sample solution comprises a mixture of CoQ<sub>10</sub> and CoQ<sub>10</sub>H<sub>2</sub> in biological fluid.
- 16) The method of claim 15 wherein said biological fluid is heparinized human plasma.
- 17) The method of claim 16 wherein the aqueous sample solution is diluted with 1-propanol.